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Environment

Air Pollution
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URBAN AIR MONITORING PROGRAM

1982

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SYNPOSIS

This report summarizes the urban air quality data collected in all twelve Saskatchewan cities during the period January to December, 1982. The cities of Regina, Saskatoon, Moose Jaw and Prince Albert are monitored under the National Air Pollution Surveillance (NAPS) Program developed by Environment Canada in conjunction with the provinces. The purpose of the program is to obtain information and trend data on the levels of air pollution in the major cities across Canada. Monitoring carried out in the remaining cities in the province is carried out under the Provincial Urban Air Monitoring Program.

Fifteen high volume air samplers were used in 1982 to collect data on suspended particulate levels in Saskatchewan. Analysis of the results indicates in general that particulate levels are remaining fairly constant. The provincial standard of 70 micrograms per cubic meter (12 month geometric mean) was exceeded only in Swift Current in 1982.

Sulphur dioxide levels in the commercial areas of the major cities are very low. The provincial one hour ambient standard of 17 parts per hundred million (450 micrograms per cubic metre) was not exceeded in 1982.

In Saskatoon, the provincial one hour standard for carbon monoxide, 13 parts per million (15 milligrams per cubic metre) was exceeded 5 times and the eight hour standard, 5 parts per million (6 milligrams per cubic metre) was exceeded on 24 occasions. In Regina, the one hour standard was exceeded on 33 occasions and the eight hour standard was exceeded 96 times.

Ozone data collected in Regina in 1982 indicate the one hour standard of 5 parts per hundred million (100 micrograms per cubic metre) was exceeded 64 times. The 24 hour average standard of 1.5 parts per hundred million (30 micrograms per cubic metre) was exceeded at least once on 62 percent of the days for which data is available. High ozone levels can occur in both rural and forested areas; it is believed that background concentrations may be making some contribution to the levels observed in Regina.

Continued maintenance and calibration problems were experienced with the Regina nitrogen dioxide monitor. As a result, reliable data for this pollutant is available only for the second half of the year.

An annual air quality index was calculated for Regina based upon the available data. The index transforms the measured concentrations of air pollutants into a single number and descriptive term that represent both the measured and publicly perceived quality of the ambient air. Although complete data was not available for all pollutants, the 1982 index was calculated to be 33 which is described as fair.

Reports dealing with the Provincial Urban Air Monitoring program dating back to 1970 are available upon request.

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1. INTRODUCTION

The current Provincial Urban Air Monitoring program was started in 1970 to give continuous information on the level of air pollution in Saskatchewan cities. The four largest centres, Regina, Saskatoon, Moose Jaw and Prince Albert are monitored under the National Air Pollution Surveillance (NAPS) Program. During the year the provincial program included all Saskatchewan cities on a limited basis. This report summarizes the data obtained from air quality monitoring during the period January to December, 1982.

2. NATIONAL AIR POLLUTION SURVEILLANCE PROGRAM

The National Air Pollution Surveillance Program was developed to obtain information on the level of air pollution in the major cities across Canada. This program is a joint project based on the co-operative efforts of both the federal and provincial levels of government. Environment Canada supplies the instruments as well as assistance with installation and maintenance. The Air Pollution Control Branch conducts routine maintenance and calibration in addition to collection of the raw monitoring data. The monitoring results are sent to Ottawa for processing and publication.

The NAPS Program consists of well over 500 sampling instruments operating in 51 cities throughout Canada.

A knowledge of the nature and extent of air pollution in the cities across Canada is vital to the planning of control programs. Therefore, one of the main purposes of the NAPS Program is to assess the quality of the ambient air in urban centres on a continuous basis. Equally important is the monitoring of trends in the levels of air pollution as changes may occur with various factors such as time, industrial activity, population and control programs.

The reader is reminded that the data presented in this report is specific to the location of the sampling instrument. It would be incorrect to assume that the concentrations reported are representative of the levels to be found in rural areas or industrial parks, for example. Monitoring locations within the cities were generally chosen in accordance with criteria established by Environment Canada; areas with excessively high or low levels of air pollution have been avoided. The Air Pollution Control Branch and various industries conduct additional ambient monitoring apart from the Urban Air Monitoring Program and the data is available upon request.

3. PROVINCIAL URBAN AIR MONITORING PROGRAM

Table 1 outlines the network of permanent air pollution monitors which were operated in Saskatchewan during 1982 for the purpose of gathering continuous data in the urban areas. As can be seen from the table, the bulk of the instruments are associated with the NAPS Program. Regina and Saskatoon were the first cities to be monitored beginning in 1970. Moose Jaw and Prince Albert were included in 1972, the same year in which the Air Pollution Control Branch began the provincial program in Estevan. Major expansions of the program took place in 1974 and 1976 with the additions of Swift Current, North Battleford, Yorkton, Weyburn, Lloydminster and Melville. A high volume monitor in Melfort was added to the program in mid 1981 and thus all centres with a population of more than 5000 are included. A sulphur dioxide monitor was also added in Lloydminster early in 1982 in part to determine the impact of increasing oil activity near the city.

TABLE 1

SASKATCHEWAN URBAN AIR MONITORING NETWORK

	Existing	Proposed
Regina	3 High-Volume Samplers 1 Sulphur Dioxide Monitor 1 Carbon Monoxide Monitor 1 Oxides of Nitrogen Monitor 1 Ozone Monitor	1 Hydrocarbon Monitor
Saskatoon	2 High-Volume Sampler 1 Sulphur Dioxide Monitor 1 Carbon Monoxide Monitor	1 Oxides of Nitrogen Monitor 1 Ozone Monitor
Moose Jaw	1 High-Volume Sampler 1 Sulphur Dioxide Monitor	
Prince Albert	1 High-Volume Sampler 1 Sulphur Dioxide Monitor	
Lloydminster	1 High-Volume Sampler 1 Sulphur Dioxide Monitor	
Estevan	1 High-Volume Sampler*	1 Sulphur Dioxide Monitor
Swift Current	1 High-Volume Sampler*	
North Battleford	1 High-Volume Sampler*	
Yorkton	1 High-Volume Sampler*	
Weyburn	1 High-Volume Sampler*	
Melville	1 High-Volume Sampler*	
Melfort	1 High-Volume Sampler*	

*Provincial monitor - Other monitors supplied by Environment Canada

4. OPERATION OF MONITORS

4.1 High Volume Air Sampler

The high volume air sampler consists of a suction motor, timer mechanism and circular chart recorder, all enclosed in an aluminum housing measuring approximately 45 cm X 45 cm X 135 cm. A large volume of air is drawn through a preweighed filter over a period of 24 hours at a flow rate of approximately 20 litres per second. After the sample is collected, the filter is removed and weighed to determine the amount of particulate matter deposited. Total suspended particulates are measured in micrograms per cubic meter of air (ug/m^3). All high volume air samplers in the Provincial Urban Air Monitoring Program are operated on the same sampling schedule, once every six days as set out in the NAPS Program.

4.2 Sulphur Dioxide Monitor

Sulphur dioxide is measured continuously by the method of coulometric titration. An air sample passes at a controlled rate through a heated selectivity filter to remove any gases which would interfere and then is bubbled into an aqueous solution containing sulfuric acid and potassium bromide. Sulphur dioxide in the ambient air disturbs an oxidation-reduction equilibrium in the solution and this is detected by an indicator electrode. An electrical current, which is proportional to the sulphur dioxide concentration in the air, is used to regenerate the solution equilibrium.

Concentrations of sulphur dioxide are reported in parts per hundred million by volume of air (pphm).

4.3 Carbon Monoxide Monitor

Carbon monoxide is measured continuously by non-dispersive infrared spectrometry. An air sample passes at a controlled rate through an air pump, a filter to remove moisture and particulates and into the analyser. Subsequent analysis is carried out by comparing the infrared energy absorbed by the air sample to that absorbed by a reference cell. The difference in energy is converted electro-mechanically into a carbon monoxide concentration. Carbon monoxide levels are reported in parts per million by volume of air (ppm).

4.4 Ozone Monitor

Ozone is monitored continuously by photometric detection of the chemiluminescence resulting from the reaction of ethylene and ozone. An air sample is passed through a reaction chamber in which a flameless gas phase reaction occurs between any ozone in the sample and ethylene. The resulting light signal is first converted into an electrical signal and then into an ozone concentration. Ozone levels are reported in parts per hundred million by volume of air (pphm).

4.5 Nitrogen Dioxide Monitor

The chemiluminescent reaction of nitrogen oxide and ozone provides the basis for the measurement of nitrogen dioxide. The concentration of nitrogen oxide is measured directly by a photo electric cell which detects the amount of light produced through a reaction with ozone in a flow reactor. Total oxides of nitrogen (ie. nitrogen oxide plus nitrogen dioxide) is measured by passing the sample through a device which converts all nitrogen dioxide present into nitrogen oxide. The monitor alternately measures and internally stores these two concentrations. The nitrogen dioxide concentration is obtained by calculating the difference between total oxide and monoxide concentrations.

5. RESULTS

5.1 Suspended Particulates

The suspended particulate concentrations obtained during 1982 are presented in Appendix A. The majority of sampling locations are classified as commercial, however, there are also residential ones which are useful for comparison. In general, the figures indicate that winter particulate levels are lower than those at other times of the year and residential concentrations are lower than commercial ones.

The annual geometric means, as shown in Table 2, indicate that suspended particulate levels in most areas declined in comparison to 1981 results. The reduction was most likely due to a return to normal precipitation levels during 1982 following a dry year in 1981.

5.2 Sulphur Dioxide

The sulphur dioxide monitoring results are summarized in Tables 3 thru 7. The first four tables indicate that the sulphur dioxide levels in the commercial areas of the major cities are very low. All annual arithmetic means recorded in 1982 were 0.0 pphm.

TABLE 2

SUSPENDED PARTICULATES
ANNUAL GEOMETRIC MEANS
(Micrograms per cubic meter, ug/m^3)

City	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Regina (C) 1620 Albert									48	57	64	66	47
Regina (C)	66	57	49	58	66	65	57	55	47	48	63	62	48
Regina (R)	49	37	29	29	43	39	36	38	29	31	41	38	31
Saskatoon (C)										73	69	63	53
Saskatoon (R)		48	44	47	50	55	63	57	53	58	57	50	47
Moose Jaw (C)			48	65	69	74	74	65	53	60	62	70	56
Prince Albert (C)			51	70	77	67	73	72	69	*	65	77	48
Estevan (R)			60	47	53	63	59	55	48	55	49	40	40
Swift Current (C)					86	80	64	49	59	67	90	83	81
North Battleford (C)					70	72	66	*	52	57	68	46	54
Yorkton (C)					71	65	51	41	42	58	44	51	57
Weyburn (C)					65	52	59	60	37	*	77	60	54
Lloydminster (C)							57	*	57	54	*	*	62
Melville (C)							33	32	25	34	26	34	36
Melfort (C)												*	50

Provincial Suspended Particulate Standards
- 24 hour average - 120 ug/m^3
- annual geometric mean - 70 ug/m^3

*- insufficient data for calculation of mean

TABLE 3

CITY OF REGINA

SUMMARY OF SULPHUR DIOXIDE LEVELS, PPHM
1982

Month	Maximum Hourly Average	Maximum Daily Average	Monthly Average
January	**	**	**
February	0.6	0.1	0.0
March	0.6	0.0	0.0
April	0.0	0.0	0.0
May	**	**	**
June	2.7	0.3	0.0
July	1.5	0.1	0.0
August	1.5	0.2	0.0
Septemver	0.2	0.0	0.0
October	**	**	**
November	**	**	**
December	**	**	**

- Provincial Sulphur Dioxide Standards
  - 1 hour Average - 17.0 pphm (450 ug/m^3)
  - 24 hour Average - 6.0 pphm (150 ug/m^3)
  - Annual Average - 1.0 pphm (30 ug/m^3)

** - No data obtained for this month due to monitor malfunction

* - Insufficient data to calculate monthly average

TABLE 4

CITY OF SASKATOON
SUMMARY OF SULPHUR DIOXIDE LEVELS, PPHM
1982

Month	Maximum Hourly Average	Maximum Daily Average	Monthly Average
January	0.0	0.0	*
February	0.0	0.0	0.0
March	0.7	0.1	0.0
April	0.0	0.0	*
May	0.3	0.0	*
June	0.2	0.0	0.0
July	0.0	0.0	*
August	2.3	0.2	0.0
September	0.0	0.0	0.0
October	0.3	0.1	0.0
November	0.6	0.1	0.0
December	0.4	0.0	0.0

- Provincial Sulphur Dioxide Standards

  - 1 hour Average - 17.0 pphm (450 ug/m^3)
  - 24 hour Average - 6.0 pphm (150 ug/m^3)
  - Annual Average - 1.0 pphm (30 ug/m^3)

** - No data obtained for this month due to monitor malfunction

* - Insufficient data to calculate monthly average

TABLE 5

CITY OF MOOSE JAW
SUMMARY OF SULPHUR DIOXIDE LEVELS, PPHM
1982

Month	Maximum Hourly Average	Maximum Daily Average	Monthly Average
January	0.3	0.0	*
February	0.4	0.0	0.0
March	0.3	0.0	0.0
April	0.0	0.0	*
May	0.0	0.0	*
June	0.0	0.0	0.0
July	0.0	0.0	0.0
August	0.0	0.0	*
September	**	**	**
October	**	**	**
November	**	**	**
December	0.5	0.0	0.0

- Provincial Sulphur Dioxide Standards

  - 1 hour Average - 17.0 pphm (450 ug/m^3)
  - 24 hour Average - 6.0 pphm (150 ug/m^3)
  - Annual Average - 1.0 pphm (30 ug/m^3)

** No data obtained for this month due to monitor malfunction

* - Insufficient data to calculate monthly average

TABLE 6

CITY OF PRINCE ALBERT
SUMMARY OF SULPHUR DIOXIDE LEVELS, PPHM
1982

Month	Maximum Hourly Average	Maximum Daily Average	Monthly Average
January	0.0	0.0	0.0
February	**	**	**
March	0.3	0.0	0.0
April	0.7	0.1	0.0
May	0.0	0.0	0.0
June	0.6	0.0	*
July	1.1	0.1	0.0
August	1.3	0.3	0.0
September	0.0	0.0	*
October	0.0	0.0	*
November	0.1	0.0	*
December	0.1	0.0	0.0

-Provincial Sulphur Dioxide Standards

- 1 hour Average - 17.0 pphm (450 ug/m^3)
-24 hour Average - 6.0 pphm (150 ug/m^3)
-Annual Average - 1.0 pphm (30 ug/m^3)

** No data obtained for this month due to monitor malfunction

* Insufficient data to calculate monthly average

TABLE 7

CITY OF LLOYDMINSTER
SUMMARY OF SULPHUR DIOXIDE LEVELS, PPHM
1982

Month	Maximum Hourly Average	Maximum Daily Average	Monthly Average
January	0.0	0.0	0.0
February	0.3	0.0	0.0
March	0.0	0.0	0.0
April	0.7	0.0	0.0
May	2.9	0.2	0.0
June	0.5	0.0	0.0
July	0.2	0.0	0.0
August	**	**	**
September		**	**
October	**	**	**
November	**	**	**
December	0.0	0.0	*

-Provincial Sulphur Dioxide Standards

- 1 hour Average - 17.0 pphm (450 ug/m^3)
-24 hour Average - 6.0 pphm (150 ug/m^3)
-Annual Average - 1.0 pphm (30 ug/m^3)

** - No data obtained for this month due to monitor malfunction

* - Insufficient data to calculate monthly average

TABLE 8

SUMMARY OF SULPHUR DIOXIDE LEVELS
MAXIMUM HOURLY CONCENTRATIONS, PPHM

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Regina	8.0	9.0	7.0	5.0	1.0	0.0	7.0	1.0	1.5	26.8	0.8	2.7
Saskatoon			5.0	3.0	8.0	17.0	6.0	5.4	5.8	0.5	0.5	2.3
Moose Jaw			8.0	6.0	15.0	5.0	5.0	4.9	0.9	2.2	2.0	0.5
Prince Albert					3.0	4.0	4.0	1.0	0.9	1.8	1.9	1.3
Lloydminster												2.9

The maximum hourly concentrations recorded over the past 12 years are shown in Table 8. In the absence of major SO_2 sources near the monitoring stations, the maximums are well below the provincial standard of 17 pphm (450 ug/m^3).

5.3 Carbon Monoxide

Summaries of the carbon monoxide data obtained during the year are found in Tables 9 and 10. Saskatoon results showed 5 and 24 exceedences of the one hour and 24 hour standards, respectively. The one hour standard was exceeded 33 times and the 24 hour standard was exceeded on 96 occasions at the Regina station.

TABLE 9

CITY OF REGINA
SUMMARY OF CARBON MONOXIDE LEVELS, PPM
1982

Month	Maximum 1 Hour Average	Maximum 8 Hour Average	Maximum 24 Hour Average	Monthly Mean
January	28.1	16.6	11.2	2.9
February	6.2	3.8	3.2	1.2
March	3.8	1.1	0.7	0.3
April	2.4	1.2	0.8	*
May	3.8	2.3	1.0	*
June	3.9	1.9	1.0	0.4
July	3.0	2.5	1.3	0.4
August	4.2	1.4	0.7	0.4
September	6.9	3.4	2.3	0.7
October	10.2	3.5	2.1	0.7
November	12.9	5.2	3.5	0.9
December	5.0	4.3	2.9	0.6

- Provincial Carbon Monoxide Standards

  - 1 Hour Average - 13 ppm (15 mg/m^3)
  - 8 Hour Average - 5 ppm (6 mg/m^3)

* - Insufficient data to calculate monthly mean

TABLE 10

CITY OF SASKATOON
SUMMARY OF CARBON MONOXIDE LEVELS, PPM
1982

Month	Maximum 1 Hour Average	Maximum 8 Hour Average	Maximum 24 Hour Average	Monthly Mean
January	17.5	10.0	4.1	0.9
February	19.3	7.4	3.9	1.0
March	11.0	3.4	1.6	0.6
April	4.3	1.9	1.3	0.4
May	7.8	4.7	2.7	*
June	2.4	0.8	0.7	*
July	**	**	**	**
August	7.9	3.0	1.3	0.5
September	8.5	3.5	1.5	0.5
October	4.9	2.4	1.1	*
November	4.7	2.7	1.3	*
December	3.3	2.2	1.1	*

- Provincial Carbon Monoxide Standards

  - 1 Hour Average - 13 ppm (15 mg/m^3)
  - 8 Hour Average - 5 ppm (6 mg/m^3)

** - No data obtained for this month due to monitor malfunction

* - Insufficient data to calculate monthly mean

5.4 Ozone

Ozone monitoring results for Regina are summarized in Table 11. The one hour standard (5 pphm or 100 ug/m^3) was exceeded 64 times and the twenty four hour standard was exceeded at least once on 195 days or 62% of the sampling time.

5.5 Nitrogen Dioxide

Table 12 summarizes the nitrogen dioxide monitoring data collected in Regina during the year. The one hour standard (20 pphm, 400 ug/m^3) was exceeded on 54 occasions and the 24 hour standard was exceeded at least once on 27% of the days for which data is available.

The results from January to May inclusive are considered suspect, however, because of unreliable span gas concentrations. During the second half of the year no exceedences of provincial standards were noted, but significant monitor downtime was also experienced.

TABLE 11

CITY OF REGINA
SUMMARY OF OZONE LEVELS, PPHM
1982

Month	Maximum Hourly Average	Maximum Daily Average	Monthly Average
January	3.5	2.8	1.8
February	4.6	3.6	*
March	7.0	6.0	3.1
April	5.0	4.1	2.5
May	5.2	3.4	2.1
June	6.7	3.3	2.5
July	9.2	3.6	2.3
August	5.0	2.8	1.9
September	3.5	1.9	1.4
October	5.5	2.0	1.1
November	11.5	3.0	1.0
December	3.3	2.5	1.2

- Provincial Ozone Standards

  - 1 Hour Average - 5.0 pphm (100 mg/m^3)
  -24 Hour Average - 1.5 pphm (30 mg/m^3)

** No data obtained for this month due to monitor malfunction

* Insufficient data to calculate monthly mean

TABLE 12

CITY OF REGINA
SUMMARY OF NITROGEN DIOXIDE LEVELS, PPHM
1982

Month	Maximum 1 Hour Average	Maximum Daily Average	Monthly Average
January+	34.9	19.5	14.3
February+	19.8	14.7	4.6
March+	18.7	14.4	9.3
April+	16.1	13.9	8.9
May+	18.9	15.3	*
June	4.0	2.9	*
July	8.6	5.7	*
August	**	**	**
September	**	**	**
October	2.9	1.3	*
November	12.4	4.9	2.0
December	6.1	2.5	1.3

- Provincial Nitrogen Dioxide Standards

  - 1 Hour Average - 20 pphm (400 ug/m^3)
  -24 Hour Average - 10 pphm (200 ug/m^3)

** - No data obtained for this month due to monitor malfunction

* - Insufficient data to calculate monthly mean

+ - Results suspect due to unreliable span gas concentrations

5.6 Annual Air Quality Index - Regina

The Federal-Provincial Committee on Air Pollution published a guideline for an annual air quality index in August, 1980*. The index transforms the measured concentrations of air pollutants into a single number and descriptive term that represent both the measured and the publicly perceived quality of the ambient air for a given time period and location. It is based upon the measured concentrations of the major pollutants which are not exceeded more than two per cent of the time.

Table 13 gives the applicable concentrations obtained during this year's monitoring and the sub-indicies which resulted according to the guideline. The overall index is calculated by averaging the three highest sub-indicies and as indicated in Table 13, these are suspended particulates, ozone and carbon monoxide (8 hour). Using the values from the table, the annual index for Regina during 1982 was calculated to be 33 which means that the air quality at the sampling location can be described as fair. Table 14 is taken from the Federal-Provincial guideline and shows the scale which is used to obtain a verbal description of the index.

Table 15 summarizes the annual sub-indicies and overall indicies obtained during the past 3 years.

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* Guidelines for an Annual Air Quality Index, a Report by the Federal-Provincial Committee on Air Pollution, August, 1980, Cat. No. EN41-22/1980, ISBN0-662-50863-7.

TABLE 13

ANNUAL AIR QUALITY SUB-INDICIES
REGINA - 1982

Pollutant	98th Percentile Concentration	Sub-Index
suspended particulates	172 ug/m^3	58
ozone (1 hour)	4.4 pphm	22
carbon monoxide (8 hour)	3.8 ppm	18.5
carbon monoxide (1 hour)	4.7 ppm	8
sulphur dioxide (1 hour)	insufficient data	
sulphur dioxide (24 hour)	insufficient data	
nitrogen dioxide (24 hour)	insufficient reliable data	

TABLE 14

VERBAL DESCRIPTOR SCALE FOR ANNUAL AIR QUALITY INDICIES

Descriptor	Numerical Values of Overall Index
Good	0-25
Fair	26-50
Poor	51-100
Very Poor	over 100

TABLE 15

ANNUAL AIR QUALITY SUB-INDICIES
REGINA - 1980 to 1982

Pollutant	Sub Index 1980	Sub Index 1981	Sub Index 1982
suspended particulates	97	93	58
ozone (1 hour)	28	32	22
carbon monoxide (8 hour)	12	27	18.5
carbon monoxide (1 hour)	7	13	4
sulphur dioxide (1 hour)	0	0	*
sulphur dioxide (24 hour)	0	0	*
nitrogen dioxide (24 hour)	*	**	**

Overall Index 1980 - 46 (fair)

Overall Index 1981 - 51 (poor)

Overall Index 1982 - 33 (fair)

* Insufficient data
** Insufficient reliable data

6. DISCUSSION OF RESULTS

High volume air monitoring results indicate a significant variation in suspended particulate concentrations between cities; the values range from a low of 31 ug/m^3 in a residential area in Regina to a high of 81 ug/m^3 in Swift Current. Many factors influence the levels obtained and give rise to the variation, including the season, weather conditions, vehicle traffic, construction, rural activity and monitor location. Particulate concentrations generally decreased during 1982 in comparison to the previous year's results. All centres except Melfort experienced normal or above normal precipitation for the year and this no doubt played a part in the decreases which occurred.

Table 16 presents a summary of the suspended particulate monitoring data obtained over the past 13 years. The standard deviations associated with the annual means for each city indicate a significant variation in the results from year to year. This is to be expected with the large number of variables that can influence the annual averages. A linear regression analysis was performed on the data from each sampling location for which five or more years of monitoring has occurred. Seven sampling locations have a negatively sloped line as the best fit of the data and five have a positive slope. A negative slope of the line indicates an overall yearly decrease in the concentration of suspended particulates and a positive slope indicates an annual increase. Over the 13 year period suspended

particulate levels in the urban areas appear to be remaining fairly constant.

TABLE 16

PROVINCIAL SUSPENDED PARTICULATE TRENDS

Sampling Location	Average Annual Geometric Mean Concentration ug/m^3	Years of Data	Standard Deviation of Annual Geometric Mean Concentrations ug/m^3	Slope of a Straight Line Fit Through Annual Mean Data ug/m^3/year
Regina (C) 1620 Albert	56	5	8.8	0.7
Regina (C)	57	13	7.2	-0.6
Regina (R)	36	13	6.2	-0.4
Saskatoon (R)	52	12	5.7	0.5
Moose Jaw (C)	63	11	8.5	-0.1
Prince Albert (C)	67	10	10.0	-0.3
Estevan (R)	52	11	7.7	-1.5
Swift Current (C)	73	9	14.0	1.0
North Battleford (C)	61	8	9.6	-2.4
Yorkton (C)	53	9	10.4	-1.6
Weyburn (C)	58	8	11.4	0.2
Melville (C)	31	7	4.2	0.5

Sulphur dioxide levels continue to be very low. No violations of provincial standards were recorded during 1982 and all annual average concentrations were 0.0 pphm.

Carbon monoxide concentrations were generally below Provincial standards and similar to last year's results. In Regina, the number of one hour exceedences increased, however, the number of 24 hour exceedences and both carbon monoxide sub-indicies decreased.

In Saskatoon, the number of one hour and 24 hour exceedences increased respectively from zero and five to 5 and 24.

Transportation sources are the largest contributors of carbon monoxide to the urban atmosphere. One confirmation of this is the lower daily average concentrations which are measured on Sundays when automobile traffic in the downtown areas is at a minimum. The highest one hour concentrations measured during 1982 were in the winter months when cold temperatures and stable conditions limited the dispersion of automobile and other exhausts. Although in excess of Provincial standards, the highest concentrations were well below the levels at which wide spread health effects or deterioration of human performance is experienced.

Ozone monitoring data indicate lower levels in 1982 compared to those of previous years. The provincial one hour standard was exceeded sixty four times as opposed to 250 times in 1981. The number of days during which at least one twenty four hour violation occurred also decreased in 1982 to 195 from 218 the previous year.

The highest monthly ozone concentrations occur from March to August; during this period strong sunlight increases the occurrence of photochemical reactions between hydrocarbons and nitrogen dioxides and ozone is formed as a secondary pollutant. Monthly summaries prepared by Environment Canada on the NAPS monitoring

program show that the levels measured in Regina are typical of the concentrations found in western cities such as Calgary and Edmonton, and lower than Winnipeg, Windsor and Toronto, for example.

The ozone standard adopted by the province was initially established as a long term goal for all parts of the country as one of the National Air Quality Objectives. The standard is being regularily exceeded in many areas of the country as a result of appreciable background levels and fluctuations in the baseline values due to weather conditions. The objectives for ozone are under review by the Federal-Provincial Committee on Air Pollution.

A special ozone study was carried out in May and November/December 1982 to gain more information on background as well as downwind ozone concentrations in the Regina area. Based on the limited data obtained during the study, it appears that daily average background levels of ozone can be as much as 67% of the 24 hour Provincial standard. In addition, ozone concentrations downwind of Regina are often significantly higher than rural levels. Hydrocarbon and nitrogen oxides sources in the city, therefore, are also contributing to the high levels being measured in the city. Additional monitoring would be required in order to verify these preliminary results.

As discussed earlier, nitrogen dioxide monitoring data for the first half of 1982 is considered to be in error because of span gas problems and the resulting over adjustment of the instrument. During the second half of the year no exceedences of Provincial standards were observed.

The annual air quality index for Regina in 1982 is 33 (fair). This value was calculated using the sub-indicies and 98th percentile concentrations given in Table 13. The index is useful for reducing a large volume of complex air monitoring data for several contaminants to a single number on a scale which gives an overall impression of air quality. The index is a severe one as outlined in the following paragraph quoted from the explanatory guideline on the index:

> "Certain assumptions and value judgements are inherent in the index, perhaps the most important being the use of 98th percentile concentrations. This is recommended by the World Health Organization and means, for example, that if an annual index number of 33 (fair) were reported, the air quality during that year would have been better than or equal to 33 for 98% of the time. It does not mean that the <u>average</u> air quality was 33. The remaining (or worst) 2% usually reflects anomalies such as weather, industrial accidents, errors in the data, and fires near the monitoring stations. The index is thus "severe"."

The overall air quality index for 1981 was 51 (poor) and therefore the 1982 result represents about a 35 per cent decrease. The major change which accounted for most of the decrease was the substantially lower sub-index for suspended particulates. As indicated earlier, most cities in the province, including Regina, experienced near normal rainfall during 1982 following a dry year. In March, May and July the precipitation recorded was in fact close to double the normal levels for the city and as a result particulate levels during the spring and early summer were much lower than in the previous two years. This substantial decrease in sub-index values over a year is a good illustration of the influence that weather conditions can have on air pollution levels. Other factors, such as industrial emissions, fuel usage, traffic patterns, monitor locations and monitor maintenance can also have a significant impact on the levels observed.

The sub-indicies for ozone and carbon monoxide also decreased during 1982 by about one third in comparison to the previous year. The trend to smaller vehicles and their lower fuel consumption may have played a part in the decreases observed for these pollutants.

Additional air monitors will be added to the Saskatoon station and an annual index will also be calculated for that city for 1983. It will be useful to compare the results for Regina and Saskatoon so that any trends that may occur can be more easily determined and confirmed.

Suspended particulate results for all centres are contained in Appendix A. Data summaries for the other pollutants are available upon request from either the Air Pollution Control Branch or Environment Canada.

APPENDIX A

SUSPENDED PARTICULATE MATTER RESULTS

SUSPENDED PARTICULATES- Regina-Station 80102R (ug/m^3 - 24 hour average) Regina-Station 80108C (ug/m^3 - 24 hour average) 1982

JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
5	23	19	4	18	-	6	46	28	5	123	53	5	46	28	4	77	49
11	20	16	10	28	21	12	18	11	11	70	38	11	94	36	10	84	48
17	19	20	16	19	19	18	16	9	17	164	77	17	-	35	16	83	41
23	26	19	22	83	18	24	33	5	23	67	120	23	52	28	22	80	52
29	27	20	28	37	29	30	43	18	29	206	208	29	25	14	28	55	28

JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
4	50	24	3	56	30	2	67	43	2	60	12	1	90	47	1	46	31
10	60	58	9	54	31	8	85	67	8	101	44	7	38	19	7	36	29
16	49	26	15	34	27	14	85	52	14	86	46	13	50	27	13	39	26
22	55	30	21	49	27	20	-	-	20	61	21	19	47	22	19	17	-
28	68	47	27	49	-	26	-	-	26	80	39	25	71	48	25	26	23
															31	19	17

SUSPENDED PARTICULATES- Regina-Station 80109C (ug/m^3 - 24 hour average) 1982

JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
5	14		4	14		6	56		5	172		5	39		4	88	
11	33		10	21		12	15		11	61		11	120		10	73	
17	14		16	24		18	20		17	164		17	93		16	92	
23	-		22	123		24	8		23	124		23	34		22	87	
29	17		28	25		30	25		29	180		29	38		28	82	

JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
4	38		3	67		2	69		2	41		1	62		1	34	
10	61		9	59		8	126		8	106		7	45		7	20	
16	-		15	37		14	103		14	68		13	36		13	37	
22	60		21	57		20	-		20	57		19	32		19	17	
28	65		27	67		26	-		26	106		25	75		25	25	
															31	15	

SUSPENDED PARTICULATES-

Saskatoon-Station 80203R (ug/m^3 - 24 hour average)
Saskatoon-Station 80209C (ug/m^3 - 24 hour average)

1982

JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
5	20	35	4	51	47	6	-	101	5	15	61	5	72	119	4	79	66
11	28	49	10	26	20	12	31	31	11	142	91	11	132	115	10	68	78
17	44	45	16	87	44	18	53	50	17	58	151	17	82	72	16	83	-
23	32	38	22	61	24	24	9	44	23	295	133	23	-	55	22	71	71
29	21	29	28	192	169	30	35	52	29	143	172	29	-	35	28	71	62

JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
4	49	35	3	-	21	2	74	61	2	70	35	1	63	43	1	-	-
10	58	43	9	44	55	8	72	54	8	83	28	7	27	26	7	-	-
16	-	54	15	-	48	14	68	59	14	95	53	13	-	35	13	20	23
22	78	61	21	38	-	20	126	71	20	62	35	19	38	27	19	18	15
28	64	52	27	73	36	26	37	33	26	65	60	25	34	27	25	37	20
															31	11	12

SUSPENDED PARTICULATES- Moose Jaw-Station 80301 (ug/m^3 - 24 hour average) 1982

JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
5	25		4	53		6	44		5	-		5	74		4	145	
11	21		10	45		12	24		11	-		11	87		10	79	
17	33		16	31		18	21		17	386		17	38		16	62	
23	30		22	41		24	42		23	333		23	60		22	102	
29	20		28	27		30	61		29	198		29	14		28	55	

JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
4	53		3	53		2	113		2	90		1	84		1	62	
10	-		9	62		8	123		8	76		7	40		7	71	
16	29		15	29		14	83		14	96		13	72		13	45	
22	-		21	44		20	-		20	110		19	53		19	29	
28	68		27	47		26	47		26	114		25	55		25	44	
															31	41	

SUSPENDED PARTICULATES- Prince Albert-Station 80401 (ug/m^3 - 24 hour average) 1982

JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
5	16		4	23		6	106		5	69		5	-		4	147	
11	28		10	9		12	18		11	80		11	-		10	101	
17	14		16	32		18	47		17	108		17	-		16	92	
23	22		22	159		24	-		23	208		23	82		22	109	
29	17		28	29		30	34		29	-		29	23		28	66	

JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
4	73		3	42		2	74		2	62		1	78		1	22	
10	73		9	51		8	132		8	52		7	41		7	21	
16	101		15	35		14	68		14	77		13	62		13	26	
22	61		21	35		20	121		20	63		19	37		19	20	
28	49		27	74		26	45		26	101		25	20		25	27	
															31	22	

SUSPENDED PARTICULATES- Estevan (ug/m^3 - 24 hour average) Residential Location 1982

JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
5		10	4		10	6		32	5		31	5		125	4		69
11		-	10		28	12		20	11		104	11		29	10		45
17		28	16		33	18		23	17		59	17		13	16		95
23		11	22		19	24		11	23		28	23		39	22		79
29		20	28		26	30		11	29		106	29		90	28		37

JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
4		54	3		-	2		67	2		19	1		43	1		46
10		-	9		-	8		87	8		87	7		69	7		79
16		-	15		69	14		68	14		41	13		41	13		59
22		-	21		27	20		66	20		32	19		119	19		24
28		-	27		92	26		110	26		104	25		74	25		14
															31		17

SUSPENDED PARTICULATES- Melfort (ug/m^3 - 24 hour average) Commerical Location 1982

JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
5	-		4	-		6	30		5	-		5	35		4	-	
11	-		10	-		10	10		11	64		11	169		10	82	
17	-		16	25		19	18		17	75		17	24		16	52	
23	-		22	22		24	7		23	-		23	46		22	94	
29	-		28	36		30	-		29	266		29	8		28	54	

JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
4	60		3	-		2	78		2	35		1	-		1	24	
10	69		9	66		8	70		8	69		7	-		7	-	
16	83		15	42		14	-		14	135		13	47		13	-	
22	107		21	51		20	104		20	94		19	49		19	-	
28	90		27	62		26	-		26	110		25	34		25	-	
															31	-	

SUSPENDED PARTICULATES- Melville (ug/m^3 - 24 hour average) Residential Location 1982

JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
5		8	4		23	6		-	5		81	5		55	4		57
11		26	10		20	12		-	11		85	11		23	10		66
17		31	16		19	18		-	17		60	17		14	16		46
23		6	22		19	24		18	23		100	23		52	22		43
29		12	28		103	30		30	29		247	29		18	28		25

JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
4		52	3		33	2		43	2		18	1		53	1		-
10		43	9		41	8		58	8		54	7		18	7		-
16		25	15		33	14		53	14		36	13		59	13		-
22		38	21		25	20		66	20		33	19		-	19		-
28		-	27		49	26		90	26		79	25		27	25		-
															31		-

SUSPENDED PARTICULATES- North Battleford (ug/m^3 - 24 hour average) Commercial Location 1982

JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
5	-		4	35		6	34		5	222		5	106		4	206	
11	14		10	14		12	22		11	142		11	100		10	112	
17	13		16	39		18	24		17	-		17	77		16	183	
23	20		22	63		24	269		23	157		23	115		22	409	
29	20		28	34		30	87		29	86		29	149		28	118	

JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
4	57		3	54		2	79		2	94		1	66		1	19	
10	-		9	63		8	57		8	79		7	50		7	19	
16	-		15	53		14	80		14	-		13	49		13	19	
22	-		21	42		20	86		20	-		19	34		19	12	
28	87		27	59		26	41		26	79		25	17		25	23	
															31	13	

SUSPENDED PARTICULATES- Swift Current (ug/m^3 - 24 hour average) Commercial Location 1982

JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
5	31		4	-		6	62		5	135		5	92		4	132	
11	52		10	-		12	241		11	132		11	146		10	123	
17	24		16	18		18	50		17	-		17	110		16	92	
23	41		22	-		24	189		23	246		23	224		22	125	
29	-		28	41		30	176		29	179		29	149		28	50	

JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
4	-		3	91		2	86		2	79		1	85		1	45	
10	92		9	-		8	101		8	71		7	-		7	105	
16	40		15	40		14	-		14	117		13	68		13	66	
22	92		21	62		20	98		20	119		19	-		19	28	
28	116		27	86		26	42		26	169		25	86		25	-	
															31	15	

SUSPENDED PARTICULATES- Weyburn (ug/m^3 - 24 hour average) Commercial Location 1982

JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
5	15		4	21		6	43		5	77		5	79		4	79	
11	18		10	38		12	26		11	76		11	91		10	94	
17	25		16	34		18	34		17	179		17	57		16	67	
23	15		22	44		24	42		23	129		23	62		22	114	
29	18		28	37		30	63		29	144		29	40		28	44	

JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
4	60		3	74		2	96		2	82		1	62		1	63	
10	101		9	-		8	115		8	91		7	46		7	29	
16	49		15	80		14	62		14	98		13	66		13	28	
22	70		21	67		20	120		20	88		19	57		19	14	
28	96		27	78		26	82		26	92		25	44		25	15	
															31	20	

SUSPENDED PARTICULATES- Yorkton (ug/m^3 - 24 hour average) Commercial Location 1982

JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
5	-		4	20		6	77		5	93		5	-		4	108	
11	8		10	-		12	100		11	68		11	-		10	136	
17	45		16	21		18	-		17	-		17	-		16	-	
23	23		22	-		24	-		23	149		23	81		22	-	
29	-		28	-		30	88		29	229		29	39		28	82	

JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R	Date	C	R
4	46		3	66		2	108		2	83		1	107		1	20	
10	63		9	80		8	104		8	140		7	31		7	-	
16	40		15	54		14	-		14	86		13	71		13	20	
22	50		21	57		20	115		20	88		19	42		19	14	
28	85		27	57		26	-		26	109		25	71		25	16	
															31	14	

APPENDIX B

LOCATION OF MONITORING STATIONS

LOCATION OF AMBIENT AIR MONITORS

CITY	LOCATION
Regina (C)	Revenue Building, Smith St.
Regina (C)	Federal Building, 1620 Albert St.
Regina (R)	Provincial Lab, Wascana Centre
Saskatoon (C)	Kelsey Institute, Idlywyld Dr.
Saskatoon (R)	Porteous Lodge, 833 Ave. P.
Moose Jaw (C)	Sask Tel Building, Fairford St.
Prince Albert (C)	Provincial Building, 1257 1st Ave. E.
Estevan (C)	St. Joseph's Hospital
Swift Current (C)	Swift Current Locker Plant, 137 1st Ave. N.W.
North Battleford (C)	Post Office
Yorkton (C)	Provincial Building, 72 Smith St. E.
Weyburn (C)	Fire Hall
Lloydminster (C)	Old RMCP Building, 44th St. and 48th Ave.
Melville (C)	St. Henry School, Main St.
Melfort (C)	Provincial Building, 105 Crawford St. E.

APPENDIX C

MONITORING EQUIPMENT INSTALLED

MONITORING INSTRUMENTS USED IN THE SASKATCHEWAN

URBAN AIR MONITORING PROGRAM

AIR POLLUTANT	INSTRUMENT MANUFACTURER	MODEL NUMBER
Sulfur Dioxide	Philips	9700
Carbon Monoxide	Bendix	8501
Nitrogen Dioxide	Thermo-Electron	14B
Ozone	Bendix	8002
Suspended Particulates	General Metal Works Misco Scientific Sierra Instruments	GMWL 2000H 680 IH 2000 HCM